

002280 9464960

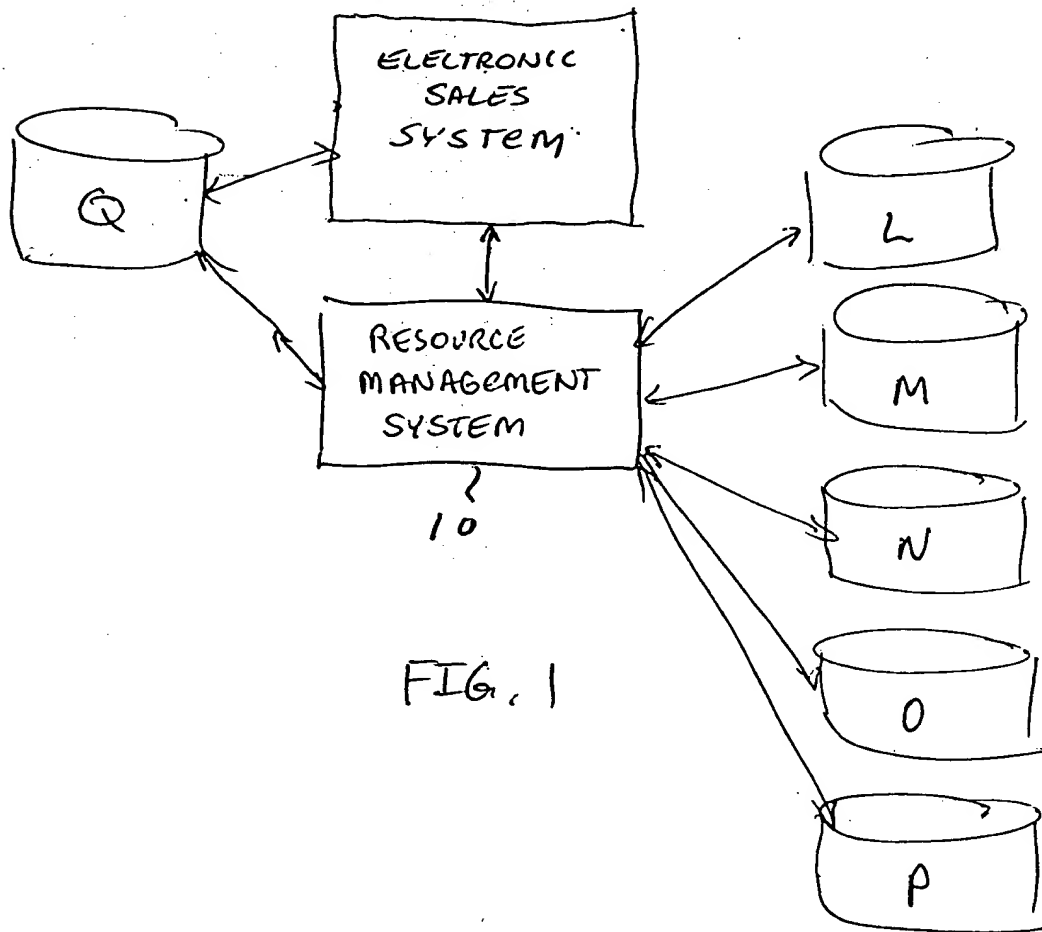


FIG. 1

FIG. 2A

General Information	Plant Name	
	Address	
	City	
	State	
	Zip	
	Phone	
	Fax	
	Contact	
	User Size	
	Industry	
Plant Profile	# of pumps/mixers	
	# of seals per pump	
	# of sealed stuffing boxes in Plant	
	% of pumps sealed	
	% of pumps packed	
	Average seal list price	
	% of seals purchased new annually	
	% of seals purchased as factory repair or rebuild kits annually	
	Factory repair/rebuild price as a % of new seal price	
	% of population requiring solid shaft seals	
	Avg. shaft seal size (in inches) in plant	
	# of Pumps, Mixers, Flushed With Seal Water into packed boxes	
	# of Pumps, Mixers, Stuffing Boxes which are flushed with seal water which require evaporation later on. (Ex. Dilute black liquor pumps in pulp & paper industry.	
Cost Information	Proposed Estimated Annual Seal Expenditure. (Revised Plant Estimate New Seals Only)	
	Average Seal List Price Per Seal	
	Average Cost of 1 hour of Labor With All Benefits Included	
	Average Cost of Shaft or Sleeve Damage	
	Avg. Cost for Bearings, Lip Seals, Gaskets, Etc.	
	Additional Cost of Seasoned Trained Professional vs. Novice Per Hour	
	Cost Per Seal Per Year For Housecleaning (Please Estimate)	
	Annual Cost Of Production Downtime	
	Actual/Estimated Plant Cost for One Failure	
	Cost of Electricity Per Kilowatt Hours	
	Average Cost Of Packing Set	
	Cost of Seal Flush Water Per 1,000 Gallons	
	Evaporation Cost of 1 Gallon of Water	
	Cost of 1 million BTUs	
	Ex. If Plant Seal Water Costs Are .15/1000 gallons and effluent treatment costs are .75/1000 gallons $.75/.15 = 5$	
	Avg. Cost of Product/Gal. (Please keep in mind that fluids like condensate have a cost and should be included)	

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Avg. Labor Cost of Unscheduled Repairs & Maintenance & Operations Combined)	
Production Cost of Machine Time Per Hour (Ex. Paper Machine)	
Cost of Housekeeping Service/Hours	
Split & Unsplit Average Price For Single W/Flow Meter or Double Seal Per Inch (Shaft Sleeve Dia.)	

FIG. 2B

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This is one example of an item on a check list

The supplier of product responsibility identifier

This checklist enables front line workers to identify existing conditions in the field which drive all decisions regarding repair/rebuild and purchase of parts, etc. The equipment checklists act as the real world indicator to arrive at scientific precise life expectancy which up until now was only obtained in laboratory conditions.

This section when completed in the field automatically feeds information back to equipment mfgs holding them responsible for life of the product and all costs associated with it. This may become obsolete over time due to the fact that mfgs will not be able to supply these specifications in the future as customers will demand real world solutions.

Knowledge Based Pictorial/Checklist

Pump Mfg. Specifications

Seal Mfg. Specifications

Verification Method

When To Check

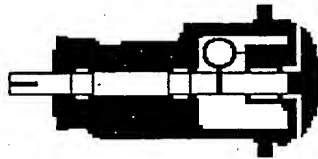
What to Check Against

What to Check Against

Accountable Party Signoff

Specifications Good/No Good

Use a dial indicator to verify perpendicularity between the stuffing box face and the shaft O.D.



5 Performed in shop before equipment is disassembled.

Manufacturers Specifications: Stuffing Box Face Perpendicularity Recommended .007" TIR max.

Manufacturers Specifications: Stuffing Box Face Perpendicularity Recommended .003" TIR max.

Example: Seal Mfg assumes responsibility for performance

No Good Value: .017

Actual

0-.002

.002 - .005

.005 - .010

.010 - .020

.020 - .030

912 days

386 days

196 days

121 days

45 days

Mfg is held accountable

Recorded from drop down menus

*

* = the recorded value that applies to your organization.

General Design

Cartridge & Component

Single Design
Double Design

Cartridge Design
Component Design

Stationary Design
Rotary Design

Balanced Design
Unbalanced Design

Tandem Design
Back to Back Design

Internally Mounted Design
Externally Mounted design

Large Clearance Design
Tight Clearance Designs

Double seal with pumping ring design
Double seal without pumping ring design

FIG. 4

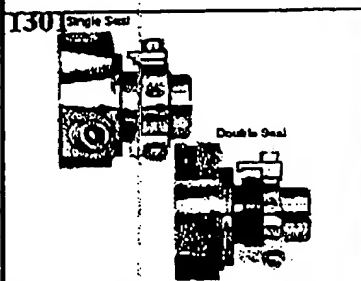
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Seal Failure Analysis Inspection Form

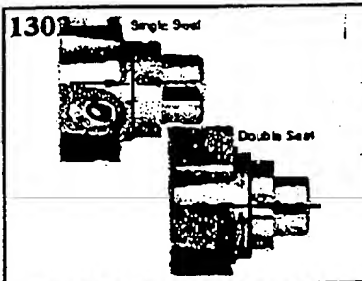
To perform a seal failure analysis, you have been provided photos for all seal types typically found in service. Simply click on the photo(s) that best identifies the conditions of the seal you are analyzing.

After all applicable pictures have been selected, click on the **"When Failure Analysis is Complete Click Here To Go To Seal Failure Analysis Report and Add Additional Comments/Notes If Required."** button to continue.

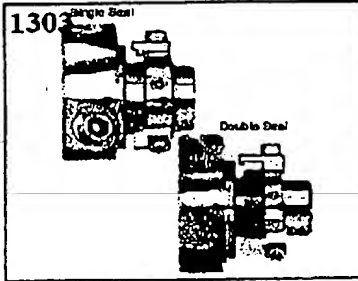
If safety issues allow, inspect parts before and after cleaning as photos require.

Cartridge Seal: Seal Settings

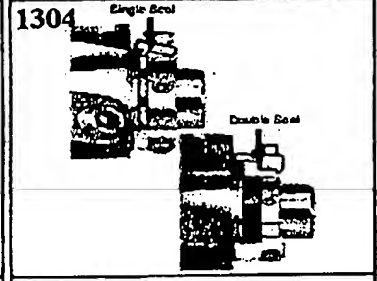
Incorrect settings due to seal being over compressed: Gap between lock collar and gland is too large. (Axial Direction)



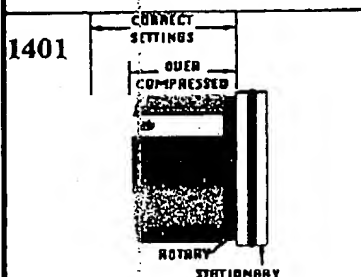
Incorrect settings due to seal being under compressed: Gap between lock collar and gland is too small. (Axial Direction)



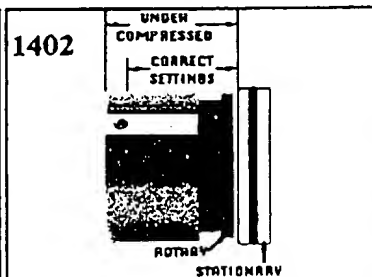
Incorrect settings due to gland face to shaft/sleeve not being perpendicular.



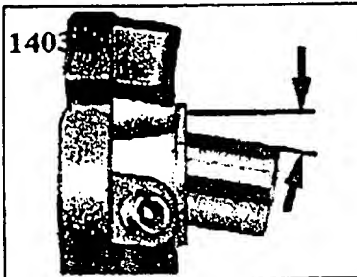
Incorrect settings due to shaft/sleeve being off centered to gland. Radial off-centering (up, down, left or right) between shaft/sleeve and gland ID

Component Seal: Seal Setting

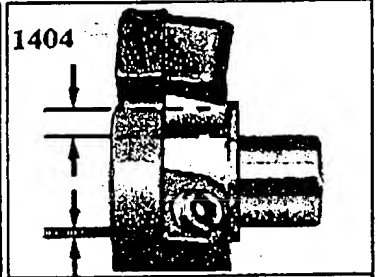
Incorrect setting due to seal being over compressed: Setting of rotary unit is wrong causing the seal to be over compressed.



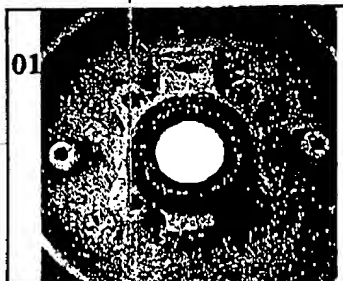
Incorrect setting due to seal being under compressed: Setting of rotary unit is wrong causing the seal to be under compressed.



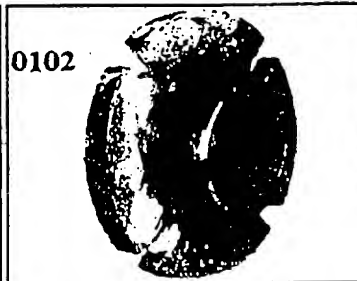
Incorrect setting due to gland face to shaft/sleeve not being perpendicular.



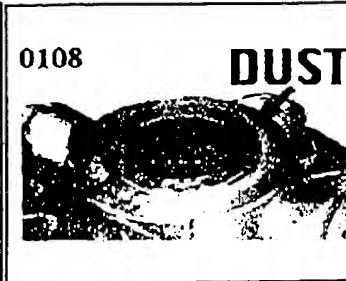
Incorrect setting due to gland not being centered to shaft.

Cartridge Seal: Environment

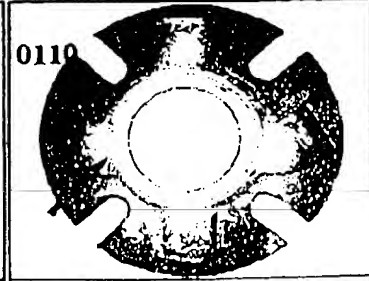
Seal area packed with product



Seal gland packed with product



Carbon dust visible on front or ID of gland.



Crystallization/Solidification of product on atmospheric side of gland

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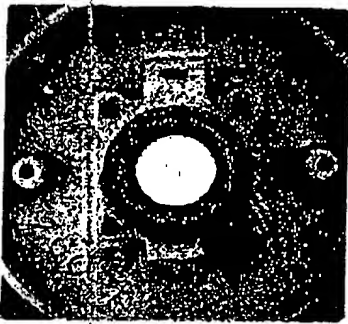


FIG. 5B

Seal area packed with product

Click
Identify the most
probable cause of
failure

RGA.FP5RGA Form

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Page 1

Corrective Action

	Reason	Cause	Verification	Corrective Action
<input type="checkbox"/>	Thermal sensitive fluids are not maintained in liquid state in the seal area, causing it to build up on seal components	Cartridge: Seal chamber temperature is raised or lowered beyond the solidification point of the process fluid.	Cartridge: Verify the actual solidification point of the process fluid and the temperature maintained in the stuffing box seal area.	Cartridge: Review materials of construction recommendations. Review API plan and heating and cooling plan recommendations to control seal environment.
<input type="checkbox"/>	Undissolved solids pack up in the seal area and on the seal components	Cartridge: Heavy concentration of undissolved solids are allowed to accumulate in the seal area.	Cartridge: Verify concentration of the % of solids present in the process stream.	Cartridge: Review materials of construction recommendations. Review API plan and heating and cooling plan recommendations to control seal environment.
<input type="checkbox"/>	Undissolved fibrous solids pack up in the seal area on the seal components	Cartridge: Heavy concentration of fibrous solids are allowed to accumulate in the back cover/stuffing box.	Cartridge: Verify concentration of the % of solids present in the process stream.	Cartridge: Review materials of construction recommendations. Review API plan and heating and cooling plan recommendations to control seal environment.
<input type="checkbox"/>	Thermal cycling resulting in premature seal failure.	Inferior Casing Design For Temperature Control	Please confirm that an inferior casing design for temperature control is being used.	Replace with a superior casing design for temperature control.
<input type="checkbox"/>	Thermal sensitive fluids are not maintained in liquid state in the seal area, causing it to build up on seal components	Component: Seal chamber temperature is raised or lowered beyond the solidification point of the process fluid.	Component: Verify the actual solidification point of the process fluid and the temperature maintained in the stuffing box seal area.	Component: Review materials of construction recommendations. Review API plan and heating and cooling plan recommendations to control seal environment.

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[illegible]

Seal		3196 (Pump)
	AV3000175A (Seal)	Seal fits with no modifications
	AV3200175EA (Seal)	Seal fits with no modifications
	5610	Special gland modifications required
	Type 9	Special sleeve modifications required
	155	
	123	

These results come from
the CA & SS from ESP

FIG 9

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		Process Fluid
		Acetone, Tem <210°F
		System Recommendations
Recommended Seal Type	Single	
	Double	Double
Metalurgy	316 SS	A
	Alloy 20	A
	Hast C	A
	Titanium	N
	Carbon	A
	Alpha Sintered SC	A
	Rxn. Bonded SC	A
Faces	Nickel Bonded TC	A
	Plated TC	N
	Ceramic	A
	Chrome Oxide	N
Elastomers	Viton	N
	EPR	A
	Teflon	A
	Aflas	N
	Kalrez	A
	Chemraz	A
	Graphoil	A
	C31- Mfg. Recommends The Use of A Model that supports an option two piece stationary head	No
	Pumping Feature Required	Yes
	Quench & Drain Required	No

FIG. 10

FIG. 11A

Skill Level Availa ble	Specify	Analyze Constraints	Work Force Average Skill Level		5	~ 1102 ~ 1100
			Individual Skill Level	John	7	
				Mary	3	
		Gather Information To Make Purchasing Decision	Work Force Average Skill Level		5	
			Individual Skill Level	John	7	
				Mary	3	
		Assess Information	Work Force Average Skill Level		5	
			Individual Skill Level	John	7	
				Mary	3	
		Perform Analysis	Work Force Average Skill Level		5	
			Individual Skill Level	John	7	
				Mary	3	
		Decide on Repair/ Rebuild of product or service	Work Force Average Skill Level		5	
			Individual Skill Level	John	7	
				Mary	3	
		Assess Safety Impact	Work Force Average Skill Level		5	
			Individual Skill Level	John	7	
				Mary	3	
		Decide Safety Requirements	Work Force Average Skill Level		5	
			Individual Skill Level	John	7	
				Mary	3	
		Assess Environmental Impact	Work Force Average Skill Level		5	
			Individual Skill Level	John	7	
				Mary	3	
		Decide Environmental Requirements	Work Force Average Skill Level		5	
			Individual Skill Level	John	7	
				Mary	3	
		Assess QC Requirements	Work Force Average Skill Level		5	
			Individual Skill Level	John	7	
				Mary	3	
		Decide QC Requirements	Work Force Average Skill Level		5	
			Individual Skill Level	John	7	
				Mary	3	
		Assess Mfgs. Capabilities	Work Force Average Skill Level		5	
			Individual Skill Level	John	7	
				Mary	3	
		Decide on Mfg.	Work Force Average Skill Level		5	
			Individual Skill Level	John	7	
				Mary	3	
		Decide on Specifications	Work Force Average Skill Level		5	
			Individual Skill Level	John	7	
				Mary	3	
		Decide and Prepare RFQ	Work Force Average Skill Level		7	
			Individual Skill Level	Bill	10	
				Ed	4	
			Work Force Average Skill Level		7	

FIG. 11B

Purchase	Receive RFQ Responses and Analyze	Individual Skill Level	Bill	10
			Ed	4
	Make Decision To Buy Product	Work Force Average Skill Level		7
		Individual Skill Level	Bill	10
Install	Assess equipment condition		Ed	4
		Work Force Average Skill Level		6
		Individual Skill Level	Jim	9
	Install Product		Ray	3
		Work Force Average Skill Level		6
		Individual Skill Level	Jim	9
Operation	Startup of Equipment		Ray	3
		Work Force Average Skill Level		8
		Individual Skill Level	Mike	10
	Operation of Equipment		Jeff	6
		Work Force Average Skill Level		8
		Individual Skill Level	Mike	10
Disposal	Disposal of Equipment		Jeff	6
		Work Force Average Skill Level		4
		Individual Skill Level	Wayne	6
Sell	Decide on Sale		Terry	2
		Work Force Average Skill Level		4
		Individual Skill Level	Sue	3
			Lori	5

002280" 976E496

7. Example of some of the data included in an "O Database" for an "O Resource" (Seals)

General Design 1200	Cartridge & Component	Single Design	Single	
		Double Design		
		Cartridge Design	Cartridge	
		Component Design		
		Stationary Design		
		Rotary Design	Yes	
		Balanced Design		
		Unbalanced Design	Yes	
		Tandem Design		
		Back to Back Design		
		Internally Mounted Design		
		Externally Mounted design	Yes	
		Large Clearance Design		
		Tight Clearance Designs	Yes	
		Double seal with pumping ring design	Yes	
		Double seal without pumping ring design		
		High Balance Ratio		
		Low Balance Ratio	Yes	
		Spring Loaded Design		
		Metal Bellows Design		
		Light Spring Load Per Square Inch		
		High Spring Load Per Square Inch		
		Wide Face Width		
		Narrow Face Width		
Glands	Design	Cartridge & Component	Single Seal with Large Dual Tangential Flush Holes	
			Single Seal with Small Straight Drill Holes Or No Flush Holes	Yes
			Double seal with two flush holes on same surface	
			Double seal with two flush holes 180 degrees apart	
	Materials of construction	Cartridge & Component	316SS Metallurgy	Yes
			Alloy 20 Metallurgy	
			Hastelloy C Metallurgy	
			Titanium Metallurgy	
	Repair & Rebuilding Procedures	Cartridge &	Practice of using OEM certified glands in repair/rebuild	
			Practice of not using OEM certified glands in repair/rebuild	
		Cartridge	Practice of replacing glands on cartridge seals with pitted surfaces	
			Practice of reusing glands on cartridge seals with pitted surfaces	
			Practice of replacing gland on cartridge seals with damaged (elongated) spring holes	
			Practice of reusing gland on cartridge seals with damaged (elongated) spring holes	
			Practice of replacing cartridge seals with worn anti-rotation lugs, pins, tabs, (tangs) in gland	
			Practice of reusing cartridge seals with worn anti-rotation lugs, pins, tabs, (tangs) in gland	
			Practice of replacing cartridge seals with missing anti-rotation lugs, pins, tabs, (tangs) in gland	
			Practice of reusing cartridge seals with missing anti-rotation lugs, pins, tabs, (tangs) in gland	
		Component	Practice of replacing glands on component seals with pitted surfaces	
			Practice of reusing glands on component seals with pitted surfaces	
			Practice of replacing gland on component seals with damaged (elongated) spring holes	
			Practice of reusing gland on component seals with damaged (elongated) spring holes	
			Practice of replacing component seals with worn anti-rotation lugs, pins, tabs, (tangs) in gland	
			Practice of reusing component seals with worn anti-rotation lugs, pins, tabs, (tangs) in gland	

Practice of replacing component seals with missing anti-rotation lugs, pins, tabs, (tangs) in gland
Practice of reusing component seals with missing anti-rotation lugs, pins, tabs, (tangs) in gland

Materials of construction	Cartridge & Component	316SS Metallurgy	Yes
		Alloy 20 Metallurgy	
		Hastelloy C Metallurgy	
		Titanium Metallurgy	

Sleeves or Barrels	Repair & Rebuilding Procedures	Cartridge	Practice of using OEM certified sleeves in repair/rebuild	
			Practice of not using OEM certified sleeves in repair/rebuild	
			Practice of replacing cartridge seals with worn drive lugs, pins, tabs, (tangs) in sleeve	
			Practice of reusing cartridge seals with worn drive lugs, pins, tabs, (tangs) in sleeve	
			Practice of replacing cartridge seals with missing drive lugs, pins, tabs, (tangs) in sleeve	
			Practice of reusing cartridge seals with missing drive lugs, pins, tabs, (tangs) in sleeve	
			Practice of replacing sleeves on cartridge seals with damaged (elongated) spring holes	
			Practice of reusing sleeves on cartridge seals with damaged (elongated) spring holes	
			Practice of replacing cartridge seals with worn drive lugs, pins, tabs, (tangs) on rotary unit set screwed to sleeve	
			Practice of reusing cartridge seals with worn drive lugs, pins, tabs, (tangs) on rotary unit set screwed to sleeve	
			Practice of replacing cartridge seals with missing drive lugs, pins, tabs, (tangs) on rotary unit set screwed to sleeve	
			Practice of reusing cartridge seals with missing drive lugs, pins, tabs, (tangs) on rotary unit set screwed to sleeve	
			Practice of replacing sleeves on cartridge seals with pitted surfaces	
			Practice of reusing sleeves on cartridge seals with pitted surfaces	
			Practice of replacing damaged (fretted) sleeves on cartridge seals	
			Practice of reusing damaged (fretted) sleeves on cartridge seals	
		Component		
			Practice of using OEM certified barrels in repair/rebuild	
			Practice of not using OEM certified barrels in repair/rebuild	
			Practice of replacing component seals with worn drive lugs, pins, tabs, (tangs) in rotary unit	
			Practice of reusing component seals with worn drive lugs, pins, tabs, (tangs) in rotary unit	
			Practice of replacing component seals with missing drive lugs, pins, tabs, (tangs) in rotary unit	
			Practice of reusing component seals with missing drive lugs, pins, tabs, (tangs) in rotary unit	
			Practice of replacing rotary units on component seals with damaged (elongated) spring holes	
			Practice of reusing rotary units on component seals with damaged (elongated) spring holes	
			Practice of replacing barrels on component seals with pitted surfaces	
			Practice of reusing barrels on component seals with pitted surfaces	
			Practice of replacing damaged (fretted) rotary sleeves or barrels on component seals.	
			Practice of reusing damaged (fretted) rotary sleeves or barrels on component seals.	

FIG.
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Materials of construction	Cartridge & Component	316SS Metallurgy	
		Alloy 20 Metallurgy	
		Hastelloy C Metallurgy	
		Titanium Metallurgy	

Face Holders	Repair & Rebuilding Procedures	Cartridge & Component	Practice of using OEM certified face holders in repair/rebuild	
			Practice of not using OEM certified face holders in repair/rebuild	
		Cartridge		
			Practice of replacing face holders on cartridge seals with pitted surfaces	
			Practice of reusing face holders on cartridge seals with pitted surfaces	
			Practice of replacing face holders on cartridge seals with worn drive/anti-rotation slots	
			Practice of reusing face holders on cartridge seals with worn drive/anti-rotation slots	
		Component		
			Practice of replacing face holders on component seals with pitted surfaces	
			Practice of reusing face holders on component seals with pitted surfaces	
			Practice of replacing face holders on component seals with worn drive/anti-rotation slots	

			Practice of reusing face seals on component seals with worn drive/anti-rotation slots	
	Materials of construction	Cartridge & Component	316SS Metallurgy Alloy 20 Metallurgy Hastelloy C Metallurgy Titanium Metallurgy	
Lock Collars	Repair & Rebuilding Procedures	Cartridge & Component	Practice of using OEM certified lock collars in repair/rebuild	
			Practice of not using OEM certified lock collars in repair/rebuild	
		Cartridge	Practice of replacing cartridge seals with damaged/oversized set screw holes on lock collars.	
			Practice of reusing cartridge seals with damaged/oversized set screw holes on lock collars.	
			Practice of replacing cartridge seals with worn drive lugs, pins, tabs, (tang) on lock collar	
			Practice of reusing cartridge seals with worn drive lugs, pins, tabs, (tang) on lock collar	
			Practice of replacing cartridge seals with missing drive lugs, pins, tabs, (tang) on lock collar	
			Practice of reusing cartridge seals with missing drive lugs, pins, tabs, (tang) on lock collar	
			Practice of replacing lock collars on cartridge seals with pitted surfaces	
			Practice of reusing lock collars on cartridge seals with pitted surfaces	
		Component	Practice of replacing component seals with damaged/oversized set screw holes.	
			Practice of reusing component seals with damaged/oversized set screw holes.	
I/B Stationary Face Materials of Construction	Cartridge & Component		Practice of using OEM certified faces in repair/rebuild	
			Practice of not using OEM certified faces in repair/rebuild	
			One Piece Carbon Soft Face Material Under Compression	
			One Piece Carbon Soft Face Material Under Tension	
			Two Piece Carbon Soft Face Material Under Compression	
			Two Piece Carbon Soft Face Material Under Tension	
			Practice of replacing soft seal faces on cartridge and component seals.	
			Practice of reusing relapped soft seal faces on cartridge and component seals.	
			One Piece Ceramic Hard Face Material Under Compression	
			One Piece Ceramic Hard Face Material Under Tension	
			Two Piece Ceramic Hard Face Material Under Compression	
			Two Piece Ceramic Hard Face Material Under Tension	
			One Piece Plated TC Hard Face Material Under Compression	
			One Piece Plated TC Hard Face Material Under Tension	
			Two Piece Plated TC Hard Face Material Under Compression	
			Two Piece Plated TC Hard Face Material Under Tension	
			One Piece Nick. Bonded TC Hard Face Material Under Compression	
			One Piece Nick. Bonded TC Hard Face Material Under Tension	
			Two Piece Nick. Bonded TC Hard Face Material Under Compression	
			Two Piece Nick. Bonded TC Hard Face Material Under Tension	
			One Piece Rxn Bond SC Hard Face Material Under Compression	
			One Piece Rxn Bond SC Hard Face Material Under Tension	
			Two Piece Rxn Bond SC Hard Face Material Under Compression	
			Two Piece Rxn Bond SC Hard Face Material Under Tension	
			One Piece Alpha SC Hard Face Material Under Compression	
			One Piece Alpha SC Hard Face Material Under Tension	
			Two Piece Alpha SC Hard Face Material Under Compression	
			Two Piece Alpha SC Hard Face Material Under Tension	
			One Piece Chrome Oxide Hard Face Material Under Compression	
			One Piece Chrome Oxide Hard Face Material Under Tension	
			Two Piece Chrome Oxide Hard Face Material Under Compression	
			Two Piece Chrome Oxide Hard Face Material Under Tension	
			Practice of replacing hard seal faces on cartridge and component seals.	
			Practice of reusing relapped hard seal faces on cartridge and component seals.	
			Practice of replacing seal faces with corrosion/pitting on cartridge and component seals.	
			Practice of reusing seal faces with corrosion/pitting on cartridge and component seals.	
			Practice of replacing rotary units with fretting corrosion visible on ID of faces	

FIG.
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		Practice of reusing rotary units with fretting corrosion (common on rotary faces that use teflon v rings) visible on ID of faces (Most common on stainless steel chrome oxide plated faces)		
I/B Rotary Face Materials of Construction	Cartridge & Component	Practice of using OEM certified faces in repair/rebuild		
		Practice of not using OEM certified faces in repair/rebuild		
		One Piece Carbon Soft Face Material Under Compression		
		One Piece Carbon Soft Face Material Under Tension		
		Two Piece Carbon Soft Face Material Under Compression		
		Two Piece Carbon Soft Face Material Under Tension		
		Practice of replacing soft seal faces on cartridge and component seals.		
		Practice of reusing relapped soft seal faces on cartridge and component seals.		
		One Piece Ceramic Hard Face Material Under Compression		
		One Piece Ceramic Hard Face Material Under Tension		
		Two Piece Ceramic Hard Face Material Under Compression		
		Two Piece Ceramic Hard Face Material Under Tension		
		One Piece Plated TC Hard Face Material Under Compression		
		One Piece Plated TC Hard Face Material Under Tension		
		Two Piece Plated TC Hard Face Material Under Compression		
		Two Piece Plated TC Hard Face Material Under Tension		
		One Piece Nick. Bonded TC Hard Face Material Under Compression		
		One Piece Nick. Bonded TC Hard Face Material Under Tension		
		Two Piece Nick. Bonded TC Hard Face Material Under Compression		
		Two Piece Nick. Bonded TC Hard Face Material Under Tension		
		One Piece Rxn Bond SC Hard Face Material Under Compression		
		One Piece Rxn Bond SC Hard Face Material Under Tension		
		Two Piece Rxn Bond SC Hard Face Material Under Compression		
		Two Piece Rxn Bond SC Hard Face Material Under Tension		
		One Piece Alpha SC Hard Face Material Under Compression		
		One Piece Alpha SC Hard Face Material Under Tension	Yes	
		Two Piece Alpha SC Hard Face Material Under Compression		
		Two Piece Alpha SC Hard Face Material Under Tension		
		One Piece Chrome Oxide Hard Face Material Under Compression		
		One Piece Chrome Oxide Hard Face Material Under Tension		
		Two Piece Chrome Oxide Hard Face Material Under Compression		
		Two Piece Chrome Oxide Hard Face Material Under Tension		
		Practice of replacing hard seal faces on cartridge and component seals.		
		Practice of reusing relapped hard seal faces on cartridge and component seals.		
		Practice of replacing seal faces with corrosion/pitting on cartridge and component seals.		
		Practice of reusing seal faces with corrosion/pitting on cartridge and component seals.		
	Component	Practice of replacing rotary units with fretting corrosion visible on ID of faces		
		Practice of reusing rotary units with fretting corrosion (common on rotary faces that use teflon v rings) visible on ID of faces (Most common on stainless steel chrome oxide plated faces)		
	I/B Faces In Combination	Cartridge & Component	Soft Face Combination Carbon/Carbon	
			Soft Face Combination Carbon/Ceramic	
Soft Face Combination Carbon/Plated TC				
Soft Face Combination Carbon/Nick. Bonded TC				
Soft Face Combination Carbon/Rxn Bond SC				
Soft Face Combination Carbon/Alpha SC				
		Soft Face Combination Carbon/Chrome Oxide		
Cartridge & Component		Hard Face Combination SC/SC		
		Hard Face Combination SC/TC		
		Hard Face Combination TC/TC		
	Hard Face Combination Cer/Cer			
		Practice of using OEM certified faces in repair/rebuild		
		Practice of not using OEM certified faces in repair/rebuild		
		One Piece Carbon Soft Face Material Under Compression		
		One Piece Carbon Soft Face Material Under Tension		
		Two Piece Carbon Soft Face Material Under Compression		
		Two Piece Carbon Soft Face Material Under Tension		

FIG
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O/B
Stationary
Face
Materials
of
Constructi
on

Cartridge
&
Component

Practice of replacing seal faces on cartridge and component seals.
Practice of reusing relapped soft seal faces on cartridge and component seals.

One Piece Ceramic Hard Face Material Under Compression
One Piece Ceramic Hard Face Material Under Tension
Two Piece Ceramic Hard Face Material Under Compression
Two Piece Ceramic Hard Face Material Under Tension

One Piece Plated TC Hard Face Material Under Compression
One Piece Plated TC Hard Face Material Under Tension
Two Piece Plated TC Hard Face Material Under Compression
Two Piece Plated TC Hard Face Material Under Tension

One Piece Nick. Bonded TC Hard Face Material Under Compression
One Piece Nick. Bonded TC Hard Face Material Under Tension
Two Piece Nick. Bonded TC Hard Face Material Under Compression
Two Piece Nick. Bonded TC Hard Face Material Under Tension

One Piece Rxn Bond SC Hard Face Material Under Compression
One Piece Rxn Bond SC Hard Face Material Under Tension
Two Piece Rxn Bond SC Hard Face Material Under Compression
Two Piece Rxn Bond SC Hard Face Material Under Tension

One Piece Alpha SC Hard Face Material Under Compression
One Piece Alpha SC Hard Face Material Under Tension
Two Piece Alpha SC Hard Face Material Under Compression
Two Piece Alpha SC Hard Face Material Under Tension

One Piece Chrome Oxide Hard Face Material Under Compression
One Piece Chrome Oxide Hard Face Material Under Tension
Two Piece Chrome Oxide Hard Face Material Under Compression
Two Piece Chrome Oxide Hard Face Material Under Tension

Practice of replacing hard seal faces on cartridge and component seals.
Practice of reusing relapped hard seal faces on cartridge and component seals.

Practice of replacing seal faces with corrosion/pitting on cartridge and component seals.
Practice of reusing seal faces with corrosion/pitting on cartridge and component seals.

Component

Practice of replacing rotary units with fretting corrosion visible on ID of faces
Practice of reusing rotary units with fretting corrosion (common on rotary faces that use teflon v rings) visible on ID of faces (Most common on stainless steel chrome oxide plated faces)

O/B
Rotary
Face
Materials
of
Constructi
on

Cartridge
&
Component

Practice of using OEM certified faces in repair/rebuild
Practice of not using OEM certified faces in repair/rebuild

One Piece Carbon Soft Face Material Under Compression
One Piece Carbon Soft Face Material Under Tension
Two Piece Carbon Soft Face Material Under Compression
Two Piece Carbon Soft Face Material Under Tension

Practice of replacing soft seal faces on cartridge and component seals.
Practice of reusing relapped soft seal faces on cartridge and component seals.

One Piece Ceramic Hard Face Material Under Compression
One Piece Ceramic Hard Face Material Under Tension
Two Piece Ceramic Hard Face Material Under Compression
Two Piece Ceramic Hard Face Material Under Tension

One Piece Plated TC Hard Face Material Under Compression
One Piece Plated TC Hard Face Material Under Tension
Two Piece Plated TC Hard Face Material Under Compression
Two Piece Plated TC Hard Face Material Under Tension

One Piece Nick. Bonded TC Hard Face Material Under Compression
One Piece Nick. Bonded TC Hard Face Material Under Tension
Two Piece Nick. Bonded TC Hard Face Material Under Compression
Two Piece Nick. Bonded TC Hard Face Material Under Tension

One Piece Rxn Bond SC Hard Face Material Under Compression
One Piece Rxn Bond SC Hard Face Material Under Tension
Two Piece Rxn Bond SC Hard Face Material Under Compression
Two Piece Rxn Bond SC Hard Face Material Under Tension

FIG.
12E

			One Piece Alpha SC Hard Face Material Under Compression	
			One Piece Alpha SC Hard Face Material Under Tension	
			Two Piece Alpha SC Hard Face Material Under Compression	
			Two Piece Alpha SC Hard Face Material Under Tension	
			One Piece Chrome Oxide Hard Face Material Under Compression	
			One Piece Chrome Oxide Hard Face Material Under Tension	
			Two Piece Chrome Oxide Hard Face Material Under Compression	
			Two Piece Chrome Oxide Hard Face Material Under Tension	
			Practice of replacing hard seal faces on cartridge and component seals.	
			Practice of reusing relapped hard seal faces on cartridge and component seals.	
			Practice of replacing seal faces with corrosion/pitting on cartridge and component seals.	
			Practice of reusing seal faces with corrosion/pitting on cartridge and component seals.	
	Component		Practice of replacing rotary units with fretting corrosion visible on ID of faces	
			Practice of reusing rotary units with fretting corrosion (common on rotary faces that use teflon v rings) visible on ID of faces (Most common on stainless steel chrome oxide plated faces)	

O/B Faces In Combination	Cartridge & Component	Soft Face Combination Carbon/Carbon	
		Soft Face Combination Carbon/Ceramic	
		Soft Face Combination Carbon/Plated TC	
		Soft Face Combination Carbon/Nick. Bonded TC	
		Soft Face Combination Carbon/Rxn Bond SC	
		Soft Face Combination Carbon/Alpha SC	
		Soft Face Combination Carbon/Chrome Oxide	
		Hard Face Combination SC/SC	
		Hard Face Combination SC/TC	
		Hard Face Combination TC/TC	
		Hard Face Combination Cer/Cer	

Elastomers	I/B Design	Cartridge & Component	O-ring Elastomer Type	
			Teflon V-Ring Elastomer Type	Yes
			Teflon Wedge-Ring Elastomer Type	
			Teflon U-Cup Elastomer Type	
	I/B Materials of Construction	Cartridge & Component	Viton Elastomer Material	
			EPR Elastomer Material	
			Teflon Elastomer Material	
			Aflas Elastomer Material	
			Kalrez Elastomer Material	
			Chemraz Elastomer Material	
			Graphoil Elastomer Material	
	O/B Design	Cartridge & Component	O-ring Elastomer Type	
			Teflon V-Ring Elastomer Type	
			Teflon Wedge-Ring Elastomer Type	
			Teflon U-Cup Elastomer Type	
	O/B Materials of Construction	Cartridge & Component	Viton Elastomer Material	
			EPR Elastomer Material	
			Teflon Elastomer Material	
			Aflas Elastomer Material	
			Kalrez Elastomer Material	
			Chemraz Elastomer Material	
			Graphoil Elastomer Material	
	Repair & Rebuilding Procedures	Cartridge & Component	Practice of using OEM certified elastomers in repair/rebuild	
			Practice of not using OEM certified elastomers in repair/rebuild	
			Practice of replacing elastomers	
			Practice of reusing elastomers	

Design	Cartridge & Component	Spring Type (Wave Spring)	
		Spring Type (Single Coil)	
		Spring Type (Multiple Coil)	Yes
		Metal Bellows Design	
		Out of Fluid Design	
		Immersed in process fluid Design	Yes

Materials | Cartridge | 316SS Metallurgy

FIG. 12F

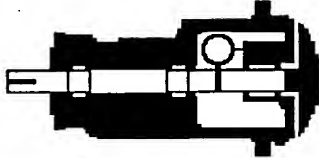
Face Energizing Mechanism	of construction	& Component	Alloy 20 Metallurgy	
			Hastelloy C Metallurgy	
			Titanium Metallurgy	
			Practice of using OEM certified springs in repair/rebuild	
			Practice of not using OEM certified springs in repair/rebuild	
			Practice of using OEM certified metal bellows in repair/rebuild	
			Practice of not using OEM certified metal bellows in repair/rebuild	
Repair & Rebuilding Procedures	Cartridge & Component		Practice of replacing springs	
			Practice of reusing springs	
			Practice of replacing metal bellows	
			Practice of reusing metal bellows	
Gaskets	Repair & Rebuilding Procedures	Cartridge & Component	Practice of using OEM certified gaskets in repair/rebuild	
			Practice of not using OEM certified gaskets in repair/rebuild	
			Practice of replacing gaskets	
			Practice of reusing gaskets	
Seal Settings				Stuffing Box Face Perpendicularity .003"

FIG. 12G

09643976-082200

002280" 94654960

Process Fluid	
Acetone: Tem <210 F	
System Recommendations	
Product Temperature	150 F
Product Crystallizes	Yes
Product Polymerizes	Yes
Product is Thermal Sensitive	No
Specific Gravity	1.1
Vapor Pressure	45 PSIA
Viscosity	15000 SSU
Concentration	75%
% Dissolved Solids	1%
% Undissolved Non-Fibrous Solids	0.50%
% Undissolved Fibrous Solids	2%

1302

1304

FIG. 13

FIG. 14A

002280" 94684960

1400~	MTBF (Mean Time Between Failure) for seals in years	
1402~	# of days/year plant operates	
1404~	# of hours/day plant operates	
1406 /	Kilowatts/hours for Avg. balanced seal	
1408 /	Additional power required for unbalanced seal	
	Average # of repacks er year	
	Average # of adjustments per year per box	
	Average Life of Shaft/Sleeve (in years) Before Replacement Is Required Due To Packing & Bearing Failure Damage	
	Avg. Seal Water (in gpm) Flush Entering Each Packed Stuffing Box , Entering the process stream	
	Average Seal Water Flush (in gpm) required for a single mechanical seal entering the process stream.	
	The Reduction in Seal Water Usage Per Stuffing Box By The Use Of Mechanical Seals	
	Change In Temp. Difference Between System Temp. and Seal Water Flush Temp. (Ex. 85 Deg.F. system temp. , 65Deg.F. Seal Water Temp = 20 Deg.F.)	
	Avg. Requirement For A Packed Pump is 2KW Per Hour. Avg. For A Balanced Mechanical Seal Is .33KW Per Hour (The Excess Power Required Per Pump Is 1.67 KW/Hour) Based on 2.000 " seal, adjust up or down by average shaft/ sleeve size in plant	
	Avg. Leakage of Each Stuffing Box in Drops/Min	
	# of Machines With Unscheduled Downtime	
Overall Plant Information	% of Equip. Requiring Unscheduled Repairs As a Result of Excess Leakage (Ex. Bearing failure due to product leakage contamination)	
	Frequency of shaft /sleeve replacement	
	% of Component Seals In Which Installation Is Not Correct The First Time	
	Increased MTBF provided by superior seal design. Average Decrease In Seal Life For The Entire Plant Seal Population Due To Existing Design Deficiencies	
	Increased MTBF provided by ESP software technologies assuring that the correct seals with correct materials of construction and environmental controls with engineering documentation provides unsurpassed plant efficiencies.	
	Increased MTBF provided plant reliability software which enables identification of problems preventing reinstallation of those problems.	
	Overall Decrease in Seal Life Due To Premature Failure. (Over compressed & Under compressed component and erroneous installations)	
	Additional Hours Req'd For Installation vs. Cartridge Design	

002280" 9/6E4960

Labor Information	Additional Hours Req'd For Component vs. Cartridge Design	
	Average Installation Time For . A Component Seal	
	Hours Required For Disassembly & Reinstallation of Seal	
	Average # of Manhours Per Repack	
	Average # of Manhours Per Adjustment	
	Average # of Manhours Per Replacement	
	# of Hours Machinery Is Down Per Year Due to Eqpt Failure Attributed to Product Leakage	
	# of Housekeeping / Hours Per Year Per Pump (Cleaning Leakage)	
	# of Hours To Install One Mechanical Seal	

FIG. 14B

FIG. 15

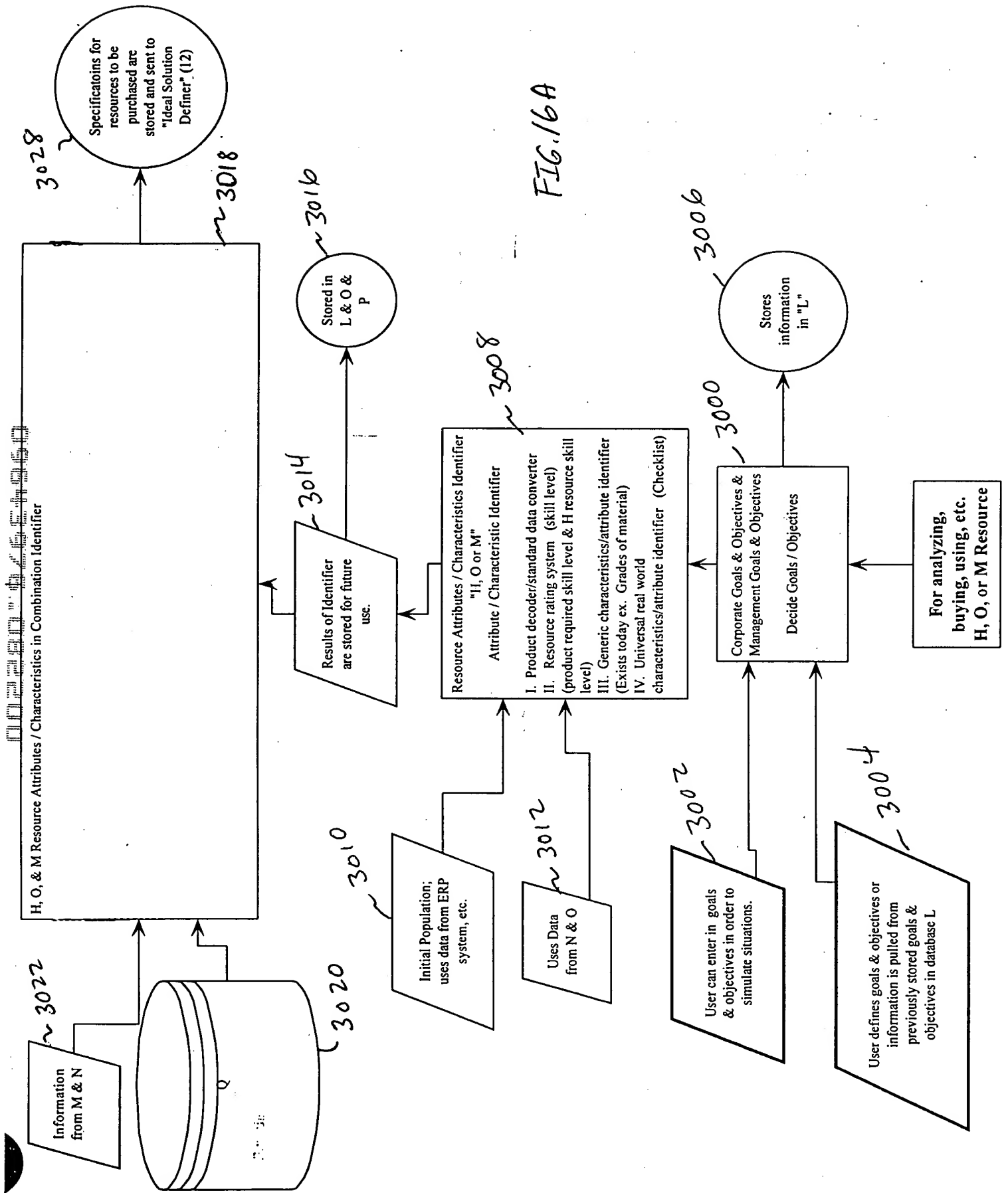
FIG. 16E

FIG. 16D

FIG. 16C

FIG. 16B

FIG. 16A



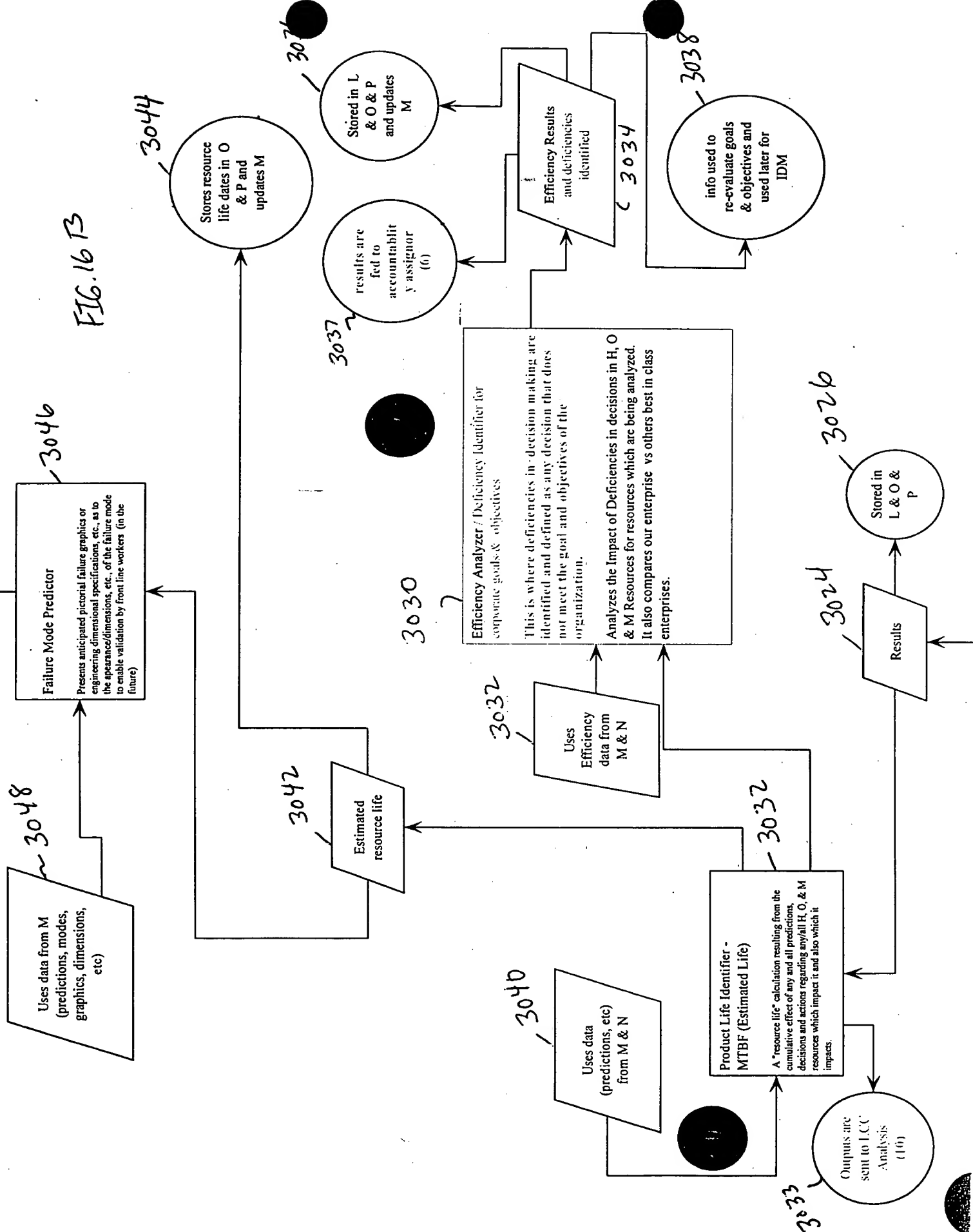


FIG. 16B

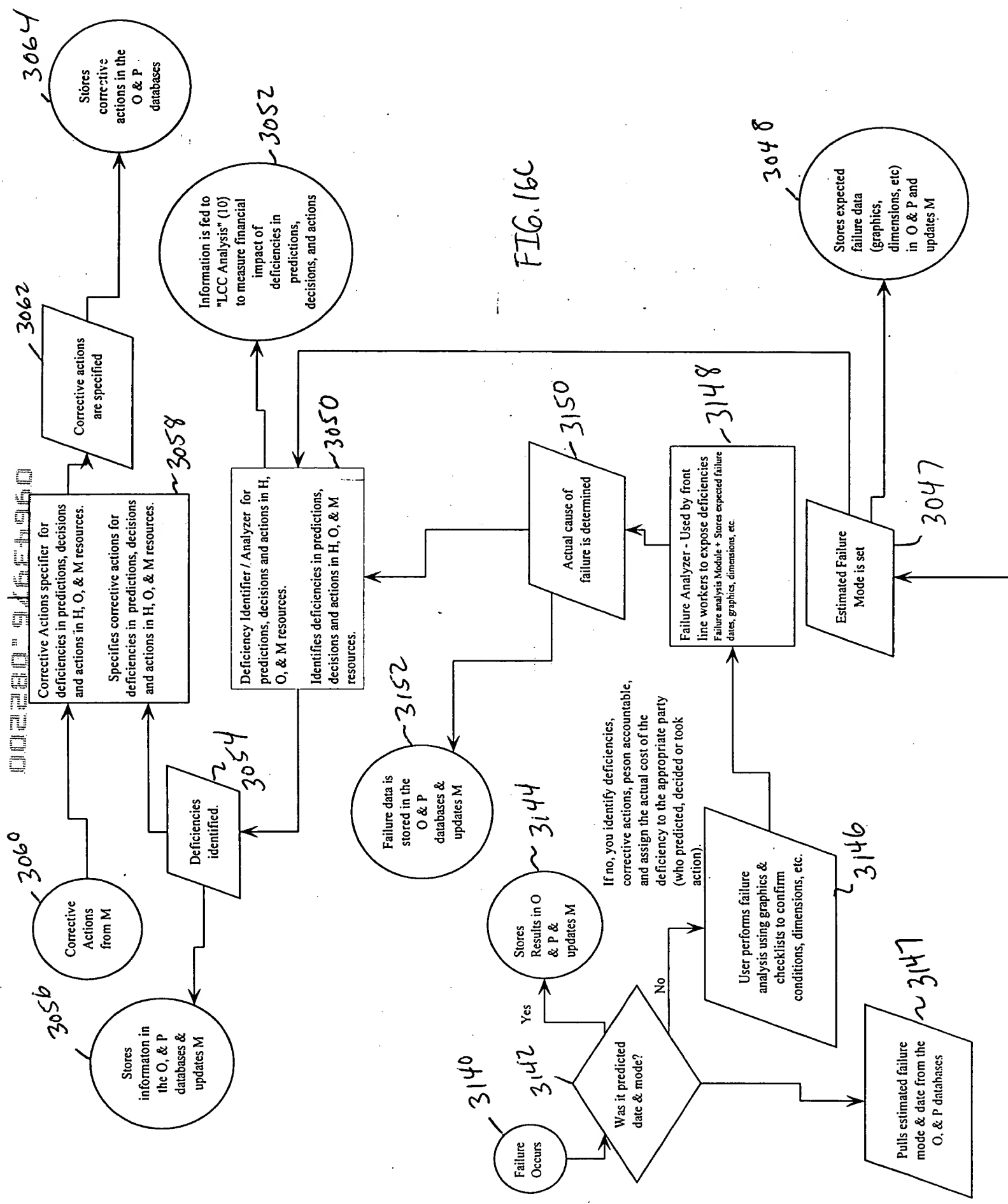
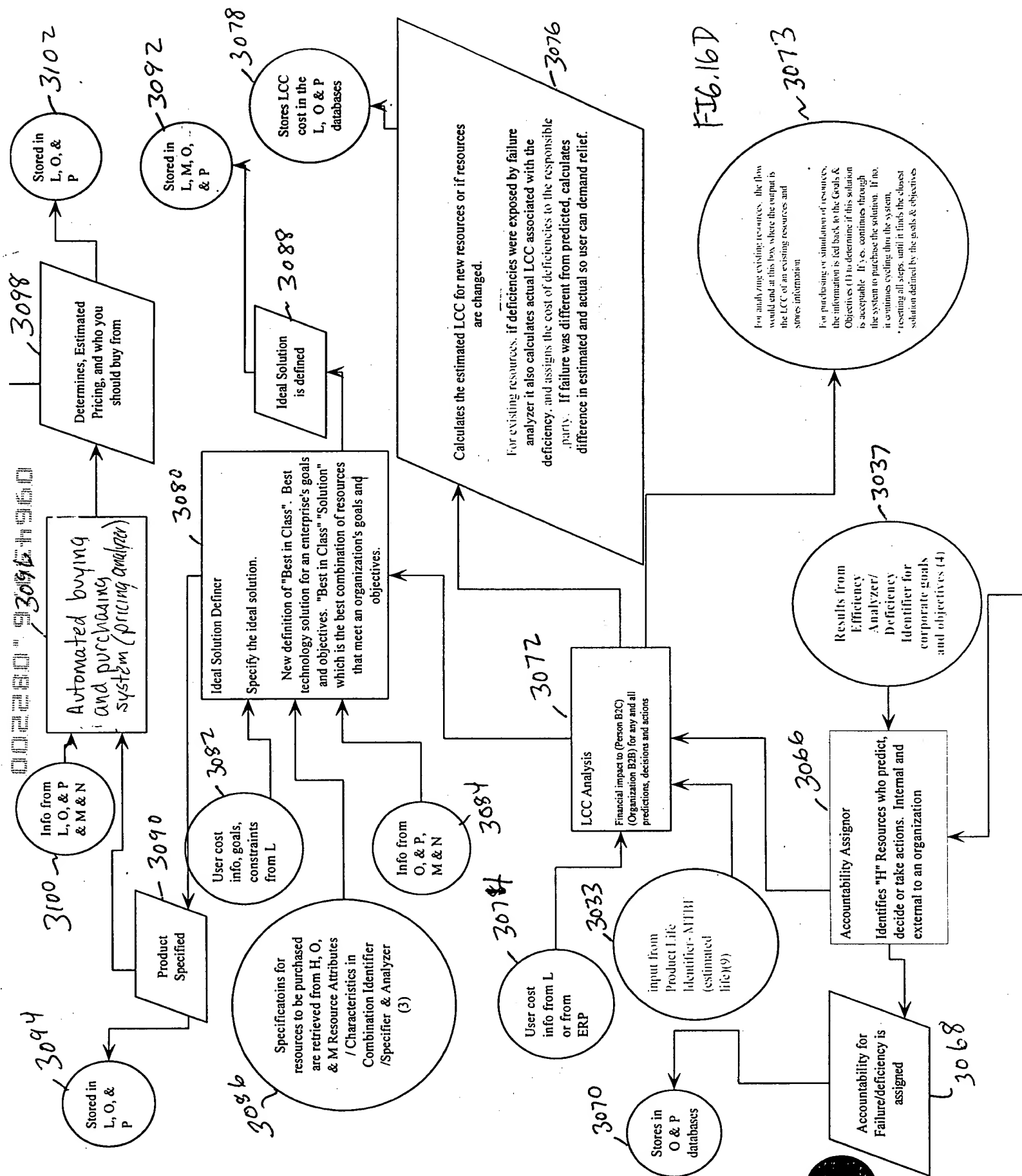


FIG. 16C



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At all steps information can be added in or retrieved regarding L, M, N, O & P data

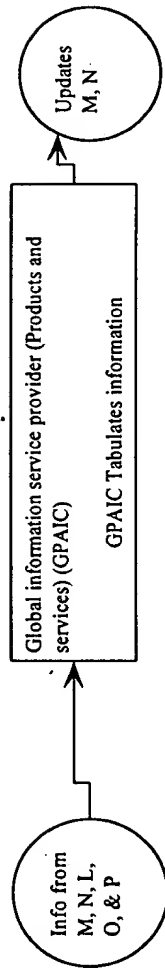
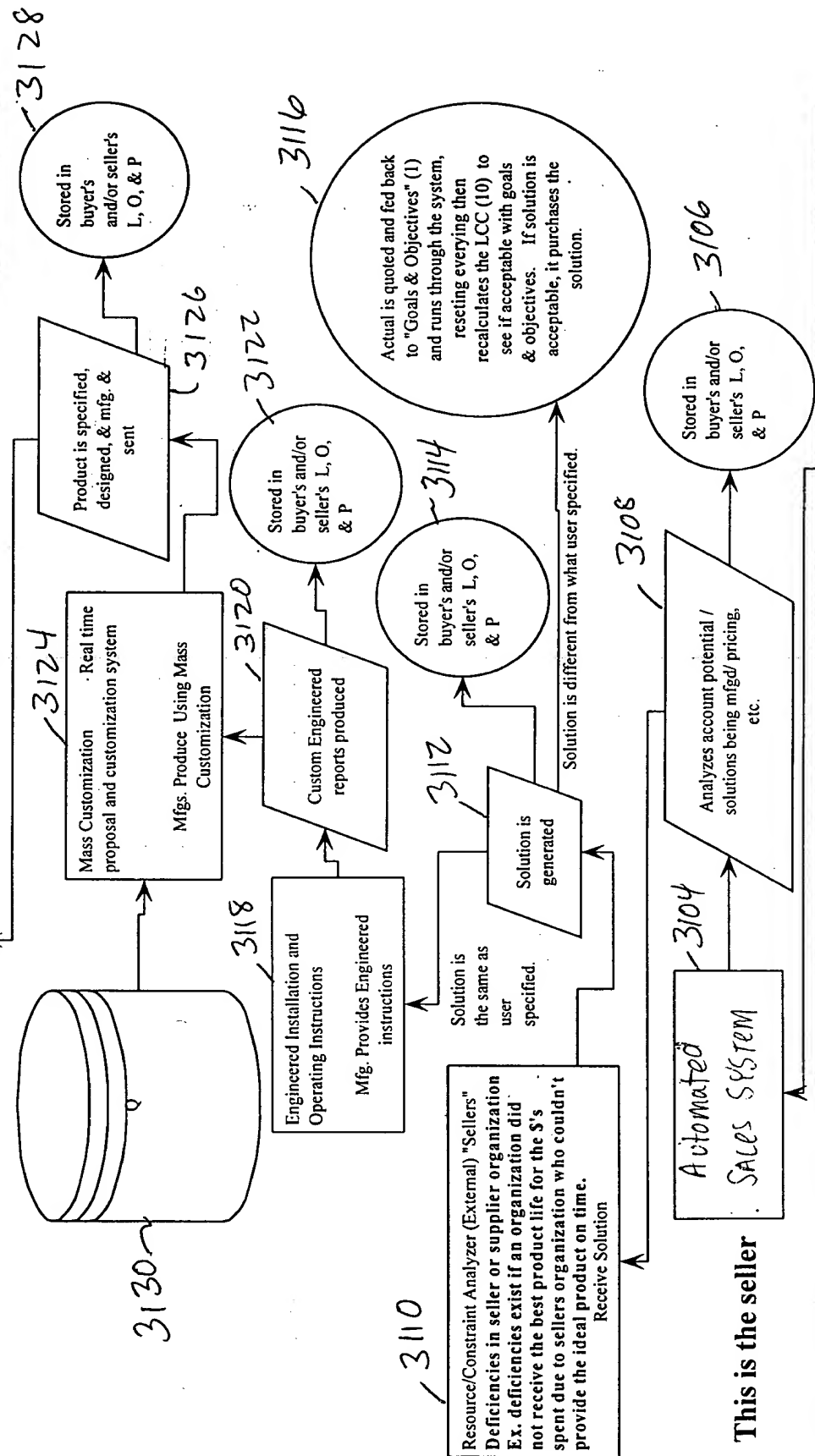


FIG. 16E

This is the buyer



This is the seller

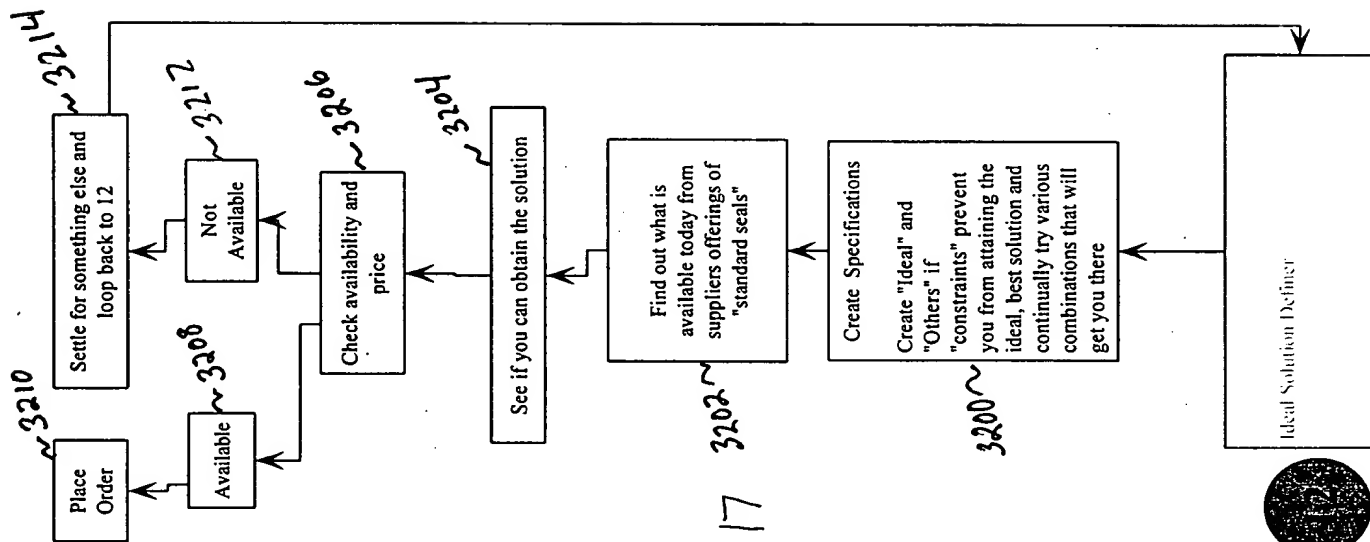


FIG. 17

FIG. 18A

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